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COMMERCIAL FISHERIES REVIEW

A REVIEW OF DEVELOPMENTS AND NEWS OF THE FISHERY INDUSTRIES
PREPARED IN THE DIVISION OF COMMERCIAL FISHERIES

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COMMERCIAL FISHERIES REVIEW

February 1948 Washington 25, D.C. Vol. 10, No. 2

EXPERIMENTAL FISHING FOR RED SNAPPER

PART I—THE USE OF HOOP NETS

By Robert O. Smith*

INTRODUCTION

During the past 10 years, the hand line fishery for red snapper and other reef fish of the Gulf of Mexico, especially as prosecuted by the large smacks, has become increasingly unprofitable. This has resulted from a decrease in the average vessel fare and from an increase in the cost of operation. Because of their heavy construction for offshore work, these vessels are expensive to build, maintenance costs are high, and it is necessary to rebuild the hulls about every 10 years.

Two factors prevent the producers of red snapper and grouper from following the general trend toward packaged fillets. One is the original high cost of the fish, and the second is the low recovery in filleting, which runs from 25 to 30 percent. To continue on a profitable basis, two changes seem necessary. First is a more efficient method of capturing fish. Second is a change, necessarily gradual, from the present type of auxiliary schooner.

There has been no lack of market for red snapper, so the obvious solution is a change to mass production methods either by reducing the number of vessels or increasing the catch per man. Many attempts along this line have been made in the past 25 years, so far without success, because of the character of the bottom. With few exceptions, it is extremely rough and covered with live and dead coral forming ridges and valleys with a height of as much as several fathoms. No type of trawl, so far developed, can be used on such bottom.

This report is, in part, a sequal to Fishery for Red Snappers and Groupers in the Gulf of Mexico, by Norman D. Jarvis, (Investigational Report No. 26, U. S. Bureau of Fisheries, Washington, 1935). After a lapse of 14 years, the problems are much the same, and the attempts to solve them now are as then aimed toward changes in methods of fishing. Since 1931, the chief improvements have been that the fish are gutted on vessels shortly after they are caught, and therefore, reach port in better condition, and a part of the catch is now quick-frozen as soon as landed.

The present experiments were undertaken in cooperation with the Warren Fish Company, Pensacola, Fla., in the hope that hoop nets, or the Pacific Coast salmon gurdies, might prove successful in either increasing the total catch or make it possible to maintain present volume with lower expense per vessel.

It cannot be expected that a comprehensive investigation of this nature could be completed in the less than two months allotted to the work. But until more complete information is at hand, the material presented and conclusions drawn may serve as a guide to the commercial fishing industry and as a basis for further experiments.

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Six cruises were made out of Pensacola, Fla., during the period October 15 to December 1, 1945. Of these, 5 cruises were devoted to trials with hoop nets; salmon gurdies were used only on the sixth cruise. (Part II-The Use of Mechanical Reels, will be published in the March 1948 issue of Commercial Fisheries Review.)

THE FISHERY

Two types of auxiliary powered sailing vessels are used for hand lining out of Pensacola, Mobile, and other Gulf ports (Figure 1). The smaller one (ching) ranges in length from 30 to 40 feet, is usually powered with a gasoline medium or heavy duty engine, with a crew of four men. These vessels rarely work outside the 40-fathom line, their trips lasting from two days to a week. They bring in a fare of from 2,000 to 5,000 pounds.

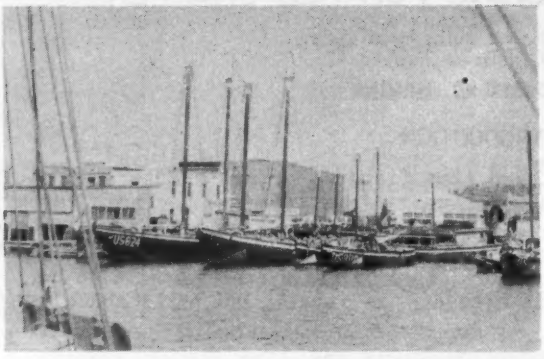


FIGURE 1 - RED SNAPPER SMACKS AND CHINGS PENSACOLA, FLORIDA

The second and larger type (smack) is a two-masted schooner from 50 to over 100 feet in length, with auxiliary diesel engines between 100 and 200 horsepower, and crew numbering up to 12. Insulated holds have a capacity of from 40,000 to 80,000 pounds of iced fish, with usual fares amounting to between 20,000 and 40,000 pounds, of which more than half are red snappers, and most of the remainder being groupers. The main fishing grounds are on Campeche Banks, off the Yucatan coast of Mexico, about 500 miles from Pensacola. A trip requires three weeks, of which one week is traveling time, and two weeks for fishing. Each vessel makes about 10 trips a year. The number of schooners operating out of Gulf ports in 1945 did not exceed 40.

Although the Pensacola-Mobile district is still the center of red snapper production, there has been a rapid development along the southwest Florida coast beginning in 1942. This fishery is centered around Tarpon Springs. Gasoline-powered motorboats from 30 to 45 feet are used with a crew of from two to four. These craft are much faster than the auxiliary powered sailing vessels used in the Pensacola region, and are, therefore, able to make faster trips to and from the fishing grounds located 25 to 80 miles offshore. Their average fare, from 2,000 to 4,000 pounds, is taken in from two to five days. The catch is mostly grouper in summer and snapper in winter. This is true generally in the snapper fishery. Red snappers spawn during July and August and there is always a lull in production at that time.

FIGURE 2 - HAND LINING - TRADITIONAL METHOD

Hand lining (Figure 2) is not only strenuous work, but needs also a high degree of skill. Good fishermen lose no time when fish are biting well. Depending on the depth, it takes from one to two minutes for the 3- or 4-pound lead

to reach bottom. While the line is going down, the fisherman leaves it unattended and cuts bait. As the line nears bottom, it is again taken in hand, and as soon as a bite is felt, the hook is set with a jerk which pulls the lead 2 or 3 feet off the bottom. It is left there for a few seconds and if fish are abundant, a bite is immediately felt on the second hook. Two fish are then brought to the surface as rapidly as their size will permit. At depths up to 30 fathoms, the size range for snappers is 2 to 8 pounds. Larger fish are found in deeper water further offshore.

Immediate attention must be given the catch on board. Although snappers and groupers keep exceedingly well on ice, they deteriorate quickly when exposed to sun or wind, and must not be allowed to dry out on deck. Every few minutes, the fish are forked down a hatch, and if they must remain on deck for a longer time they are wetted down at frequent intervals with sea water. The catch is gutted and iced at the end of each day, sometimes oftener if the rate of fishing permits.

Finding fish is the responsibility of the captain. On approaching the grounds, continuous soundings are taken with the armed lead. The depth and character of the bottom enable him to find the spot he is looking for. The lead also carries a baited hook, and at the first bite, several other fishermen put their lines over. If fish are biting, a flag buoy is put over and fishing is continued by drifting around the buoy. Because of variable winds and current, the main engine is used along with the steadying effect of the mainsail to maintain position. On most of the grounds, fish do not bite at night, but there are a few places, notably off the Texas coast, where night fishing is very good.

EXPERIMENTAL FISHING

Vessel and Equipment

The schooner Seminole, belonging to the Warren Fish Company, Pensacola, was refitted for experimental fishing. The registered dimensions of the schooner are 80' x 21' x 9'. Actual draft is 14 feet; tonnage, gross 71, net 64. The distinguishing characteristics of the Seminole is a pilot house around the wheel box at the stern. Pilot houses are not favored by most vessel captains as they say they cannot observe the set of the sails conveniently. Other non-standard equipment included an echo sounder, radio compass, and ship-to-shore phone.

Of the various navigation and communication devices installed aboard the Seminole, the echo sounder was by far the most useful. With it, it was possible to sail directly to the approximate depth desired, without losing time to take soundings with the lead.

Amidships on deck just forward of the engine trunk was a 3-drum hoist, such as is used on shrimp trawlers. This machine has a rating of 600 pounds pull on the cable with a safety factor of five. The lower and middle drums have a capacity of 800 feet of 3/8-inch diameter steel cable, while the upper drum has a capacity of 550 feet. The hoist is connected by an extension shaft and chain sprocket drive with a power take-off of 15 horsepower on the front of the main diesel engine. The rated capacity of the power take-off is 1,200 pounds.

Originally, it was the intention to operate a hoop net off both the starboard and port sides, but this proved impractical, due partly to strong currents which would sweep one net under the ship, and partly to lack of time to train the crew. But two 12-foot nets could not have been lifted together anyway, as neither the

power take-off nor the winch had sufficient power for this much strain. Both were overloaded with one 12-foot net.

The drums were fitted with 3/8-inch diameter flexible steel trawling cable such as is used in the shrimp industry. This cable has an allowable working load of 2,400 pounds, with a factor of safety of five. Since the cable gave no trouble, the load in lifting a 12-foot net seems to have been between 1,200 and 2,400 pounds.

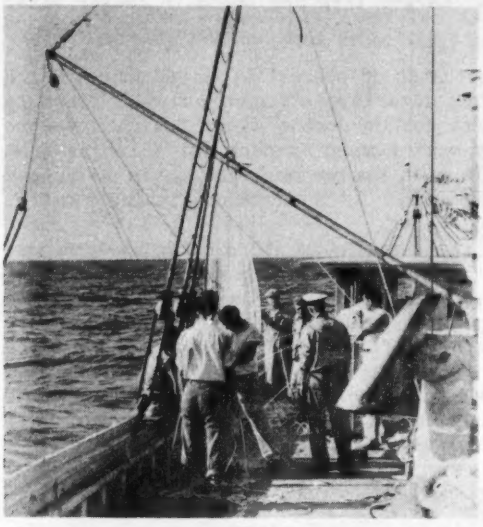


FIGURE 3 - SEMINOLE - LOOKING AFT SHOWING BOOM

The booms on which the nets were swung overside were 16-foot lengths of 3-inch galvanized steel pipe, the butt end attached to the mainmast by a pintle. A 2-inch pipe was inserted in the outboard end to make an extension, increasing the over-all length to as much as 24 feet. The actual length of boom needed depends on the angle of suspension. Details of location and installation are shown in Figure 3. The boom was guyed fore and aft so that the cable led directly from the winch through a bronze sheave attached at the outer end of the boom, thence down overside to the hoop net. When not in use, and to facilitate docking, the boom was raised until the end did not project over the side. The nets were secured on deck alongside the mainmast rigging.

Fishing

The period devoted to fishing with hoop nets extended from October 18 to December 1, 1945. In this time, five trips were made offshore from Pensacola, usually in a southeasterly direction. These trips were made on October 18-19, 24-25; November 9-10, 16-17; and November 29-December 1. On the first trip, ¼-inch diameter tiller cable was used instead of trawling cable. It broke after 4 lifts. The second trip was blank as rough seas made it impossible to keep the nets on the bottom. This inability to work except in calm weather is the major disadvantage of hoop nets. It is also necessary to anchor the vessel which otherwise would drift away from the net.

Experimental data were obtained on four trips of approximately two days' duration each. Eighty-seven lifts were made with hoop nets with a total catch of 367 marketable fish, comprising 191 snappers, 165 porgies, and 11 leatherjackets. The catch per trip is summarized in Table 1. A total of 161 hours was spent away from the dock. Of these, 13 hours were required on each cruise to go to and return from the fishing grounds. Twelve hours each trip were taken up searching for fish, leaving 9 hours and 24 minutes actually employed in hoop net fishing. This is roughly 6 percent of the total time away from the dock.

Fishing procedure with the hoop nets was as follows:

On leaving Pensacola, the echo sounder was operated until a depth of from 31 to 37 fathoms was indicated. The vessel then slowed, and the armed lead with

baited hook was used to determine the character of the bottom and presence of fish. As soon as a snapper was caught, several hand lines were put over. When these began catching fish, a buoy was dropped, and the ship anchored near it.

Table 1 - Average Catch Per Lift 10 & 12-foot Diameter Rings

Date	Cruise	No. Lifts	Snappers	Porgies	Leather-jackets	Total fish	Average Per Lift			
							Snappers	Porgies	Leather-jackets	All
Oct. 18 19	1	4	4	17	0	21	1	4	0	4
Oct. 24 25	2	Heavy weather prevented trials								
Nov. 9 10	3	17	4	11	2	17	.25	.66	0	1
Nov. 16 17	4	49	85	40	9	134	2	1	.2	3
Nov. 29 30 Dec. 1	5	17	98	97	0	195	6	6	0	11
Totals	5	87	191	165	11	367	2.2	1.9	0	4.2

Since the current at the bottom, both in direction and velocity, is frequently different from that at the surface, hand lines must be used to show which side of the vessel is preferable for operation of the hoop net. It is essential that any drift should carry the net away from the vessel. Having determined drift, a boom on the appropriate side of the vessel is swung outboard far enough so that the hoop net will not foul the side of the ship when lifted to the surface. The net is then attached to the cable and swung overside, the bait bags filled and hung in the center of the hoop, and the winch brake eased to lower the net to the bottom. The cable was marked at 5-fathom intervals, and since the depth was known, the hoop net was checked as it neared bottom to prevent overrunning of the cable or damage to the net from striking bottom. After an interval on the bottom, varying from a few seconds to 5 minutes, the winch clutch was engaged at full speed and the net drawn to the surface as rapidly as possible. The bag of the net was then brought aboard, fish removed, bait bags replaced with freshly-filled ones, and the operation repeated.

Records of hoop net operation for all cruises show that from 4 to 18 minutes were needed to make a lift, depending, of course, on how long the net was left on the bottom. The 12-foot net was timed to determine the rate of sinking, and speed of hauling to the surface. Records were kept of 17 lifts from a depth of 37 fathoms. Time to sink to the bottom varied from 105 to 135 seconds, with an average of 118 seconds, or roughly, 2 minutes. This is at the relatively slow rate of 1.9 feet per second. The net was lifted from bottom to surface in from 35 to 55 seconds, the average being 42.5 seconds, or an average rate of lift of 5.3 feet per second. Since most of the cable was off the drum when the net was on bottom in 37 fathoms, and as the revolutions of the drum remained constant, the actual speed of the net was increasing as the surface was approached, due to successive layers of cable increasing the diameter of the drum. No check could be made as to whether or not the rate of lifting was ideal, but it was sufficiently fast for the snapper's swim-bladder or "pork" to expand with decrease of water pressure near the surface, and to protrude from the mouth.

The size, rigging, and handling of the hoop net itself were subject to continual change, with no final form at the time the experiments were discontinued.

Based on observations of the sea bass fishery carried on at New Smyrna Beach, Fla., 1/ the original hoop net rings consisted of 1-inch diameter steel rods bent

1/ "Fishing Hoop Nets in Florida," by K. P. Foster, appeared in the October 1945 issue of Fishery Market News, pp. 5-7. Also Separate No. 113.

and welded into circles of 8, 10, and 12 feet diameter. The 8- and 10-foot rings were quickly discarded on finding that the 12-foot rings could be handled as expeditiously as the smaller sizes. The first nets were attached to the lifting cable by four bridles of ½-inch cotton rope; and the bag of the net was made of 2-inch stretched mesh linen twine size 14/8. This was the heaviest linen twine then available. It was used in natural color without treatment of any kind. This mesh netting catches small fish, but does not tangle easily on the bottom, and the natural color closely resembles the bottom.

In addition to the extra weight and difficulty of handling the 12-foot ring, the length of the bag increased from 9 to 14 feet; and the four cotton rope bridles which worked so well on the small net, fouled badly on the larger one; 30 galvanized rings, 2-inch diameter, attached to the end of the 8-foot net provided sufficient weight to carry it down, and minimized chafing on the bottom, but the weight of 35 rings, 4-inch diameter, was not enough to carry down the 12-foot net.

Considerable difficulty was experienced with the bridles which attached the net to the lifting cable. After trying both four and six bridles made of cotton rope, four bridles were made from 8-foot lengths of 3/8-inch diameter steel rod, fastened to the cable by a shackle. This kept them in a fixed position when the net was on the bottom. Three steel rods would be an improvement, but leaves too large an arc of the ring unsupported and would require very heavy construction. As it was, it was necessary to strengthen the 1-inch diameter rod by welding to it a second ring of ½-inch diameter rod. This was attached to the lower outside of the main ring. Before this was done, the pull on the ring occasionally folded it up like a pocketbook.

After the first few lifts, it was apparent that both the power take-off and the hoisting winch were overloaded. The weight of the ring could not be reduced, nor was it desirable to slow the rate of lift. There remained the possibility of reducing the drag of the net by using a bag of larger mesh. This was constructed of 4-inch stretched mesh cotton twine.

A comparison of the catching power of various combinations of bridles and webbing is shown in Table 2. The data pertains to the 12-foot diameter net, as the 8-foot net was not used and the 10-foot net used only twice. The obvious conclusion from the Table is that 2-inch mesh netting and four steel bridle rods

Table 2 - Catch According to Number and Type of Bridles and Mesh of Net
12-foot Diameter Ring Only

Netting, Size and Kind	No. Lifts	Snappers	Porgies	Leather-jackets	Total fish	Average Per Lift			
						Snappers	Porgies	Leather-jackets	All
2" Linen[1]									
Bridles									
6 cotton rope	9	2	6	0	8	-	-	-	1
6 steel rods	13	9	24	4	37	.7	2	.3	3
4 " "	17	69	101	1	171	4	6	0	10
Totals	39	80	131	5	216	2.0	3.4	0.1	5.5
4" Cotton[1]									
Bridles									
6 steel rods	8	33	7	0	40	4	1	0	5
4 " "	28	27	8	3	38	1	.3	.1	1.4
4 " " plus extra bait	10	49	8	3	60	5	1	0	6
Totals	46	109	23	6	138	2.4	0.5	0.1	3.0

1/ Stretched mesh. Note: 2 hauls with 10-foot ring omitted.

are the most efficient combination, as they averaged 10 fish per lift, compared to 3 fish per lift using 4-inch cotton netting. From a commercial standpoint, these figures are useless, for fish are sold by the pound instead of by the piece. Lacking both a measuring board and scales, no figures on sizes and weights can be given. However, the observations of all persons on board were that the 4-inch cotton mesh caught larger fish than the 2-inch linen.

Superiority of steel rods over cotton rope for bridles is less open to question, except on the hypothesis that "there are always more fish on the port side." Tests were made with the vessel at anchor, with one hoop net with cotton bridles operated from the starboard boom, and a net with steel bridles swung from the port boom. These nets were raised and lowered alternately. During this test, members of the crew were hand lining on both sides of the vessel with good results.

Fluctuations in Catch According to Time of Day

It is generally true that fish bite best in the early morning and late afternoon, but not so well in the middle of the day. This theory is not too clearly borne out by the data in Table 3. For clarity, the 24-hour day has been used. It will

Table 3 - Catch According to Time of Day

Time	No. lifts	Snappers	Porgies	Leather-jackets	Total fish	Average per lift
6:00-8:59 a.m.	10	34	23	3	60	6.0
9:00-11:59 "	31	18	33	7	58	2.0
12:00-2:59 p.m.	25	73	91	0	164	6.5
3:00-5:59 "	20	66	17	1	84	4.0
6:00-8:59 "	1	0	1	0	1	1.0
Total	87	191	165	11	367	4.2

be noted that the best catches were made between 6 and 9 a.m., and from noon to 6 p.m., with relatively few fish taken from 9 a.m. to noon, although more lifts were made during this time of day than at any other. In the late fall, sunrise is near 6 o'clock; sunset, about 5:30. The best fishing was from 7:30 to 9:30 a.m., and from 2 to 4:30 p.m. Using hand lines, only occasional bites were felt during darkness, both morning and evening. On the first trip, October 18, a 1,000-watt floodlight was rigged over the stern at 7:30 p.m., and at the end of 1½ hours only a few squid, 2 small sharks and occasional schools of unidentified small fish 6 inches long had been observed.

Catch Versus Time Net Remained on Bottom

Table 4 shows variations in number of fish caught on the basis of number of seconds the net remained undisturbed on the bottom. In evaluating the Table, it is recognized that there are not enough lifts of 2½ to 5 minutes to give reliable averages. Too much emphasis should not be placed on the results of the 195-224-second group. One of the five lifts brought up 39 small snappers (2-pound) and 31 porgies for a total of 70 of the 94 fish in the group. Among the factors other than time which may have contributed to this freak catch are most likely an unusual number of hungry fish congregated in a tight school, and the certainty that the technique of handling the net was perfect. However, it is believed that the net should be left on the bottom for at least 1½ minutes. This is in contrast to the hoop net fishery for sea bass of the Atlantic Coast of Florida, where very good results are obtained from less than a minute on the bottom except for the first lift, which is left down 4 minutes to attract fish by diffusion of bait. The main point is how to obtain the largest possible catch per hour of fishing. Toward this end, it is important to discover the minimum practical time for leav-

ing the net down, for it takes an average of 2½ minutes for the net to sink to the bottom and be lifted to the surface from 37 fathoms, and it takes from 2 to 5

Table 4 - Catch Versus Time of Net on Bottom

Number Seconds on Bottom			No.						
Minimum	Average	Maximum	lifts	Snappers	Porgies	Leather-jackets	Total fish	Average per lift	Empty lifts
0	30	44	15	9	6	0	15	1.0	8
45	60	74	15	12	7	2	21	1.4	8
75	90	104	20	39	25	3	67	3.3	6
105	120	134	14	23	24	4	51	3.6	5
135	150	164	8	15	17	0	32	4.0	2
165	180	194	6	26	27	0	53	9.0	3
195	210	224	5	59	35	0	94	19.0	1
225	240	254	3	4	24	0	28	9.3	1
255	270	284	1	4	-	2	6	6.0	-
		Total ...	87	191	165	11	367	4.2	34

minutes to get the catch on deck and snap on fresh bait bags. Excluding a long series of blank hauls, and the cases where the net was left on bottom only a few seconds, the usual number of lifts per hour was from 6 to 7, or one lift every 9 minutes.

Observations on Netting

Considerable cutting of the net on coral bottom was anticipated, but such damage was negligible. All fishing was on dead coral and it is doubtful if nets could be used on live coral. At the time the experiments were discontinued, a hunt was started to find a more satisfactory netting than the 2-inch square linen costing over $4.00 a pound, with the added objection that the small mesh caught many fish too small for market. It was expected that a larger mesh of cotton would not only be cheaper, but also do two things: let the small fish out, and put less strain on the machinery. The only other netting immediately available was a heavy tarred cotton twine of 4-inch square mesh. This was too large, and 3-inch square mesh of No. 15 cotton is recommended.

Bait

Compared with hand lining, larger quantities of bait are needed for hoop net fishing. From 2 to 5 pounds of ground bait were put in the bags for each lift. Fifty to one hundred pounds of frozen jacks (Elops saurus) were used per day. It is essential to have the power operated meat grinder. This may be made by replacing the handle on a restaurant-size hand-grinder with a sprocket which is driven by a chain from a gasoline engine.

Operational Procedures

It is important here to take note of certain techniques which, perhaps almost as much as the abundance of fish, determine the success or failure of hoop nets.

First is getting the net properly positioned on the bottom. While it is desirable to get the net on the bottom as fast as possible, it is even more important that it should rest there with the bag neatly folded like an accordian, the ring or hoop lying freely on top, and the bridles not fouled with either bag or ring. If any of these conditions are not attained, very few if any fish will be retained in the upward journey, for the bag will not open completely and instantly. Also, in going down, the heavy steel hoop tends to travel faster than the net, and if not checked, the bag will be turned inside out, resulting in complete fouling on the bottom. Two helpful corrective measures are to slow down

the descent of the hoop by letting it pull cable off the drum; and to speed up the ball of the bag by attaching galvanized rings to the bottom. Depending on the size of the net, from 5 to 10 pounds of rings may be needed.

The second essential is that the winch must pick up the net swiftly and positively or fish will have enough warning to escape from inside the ring before it gets under way. A slipping clutch on the winch spells certain failure. Bottom fish instinctively flee downward to escape danger. Once inside they will seldom be lost so long as the lift continues smoothly upward.

The third important thing is the right use of bait. It is frequently difficult to know how to use bait to best advantage, for there is considerable difference whereby various fish find food. For example, sharks are attracted chiefly by smell, but barracuda strike at disturbances or moving objects without any regard for odor. However, the vast majority of fish follow a provocative scent back to its source.

For success with hoop nets, bait must first attract fish to the center of the net and second, hold them there. Ocean currents, carrying the odor from a piece of fish or other bait satisfy the first requirement, but differences of opinion exist as to the second point. The evidence in these experiments points to the need for relatively large quantities of bait. At first, one bait bag holding about 2 pounds of finely ground fish was tied in the center of the ring. Most of this bait probably was washed out of the bag by turbulence on the way down and up; some may have been eaten by small fish, at least the bag was empty on reaching the surface. Also, only small fish under 2 pounds weight were caught. A second bag was added, seemingly with better results. Even with two bags it was found that most of the bait was gone. So to the bags of finely ground bait was added a bag of chunks of fish (Figure 4). It seems that larger fish were caught with this combination, though due to other complicating factors, no statistical evidence is available to support the observations.

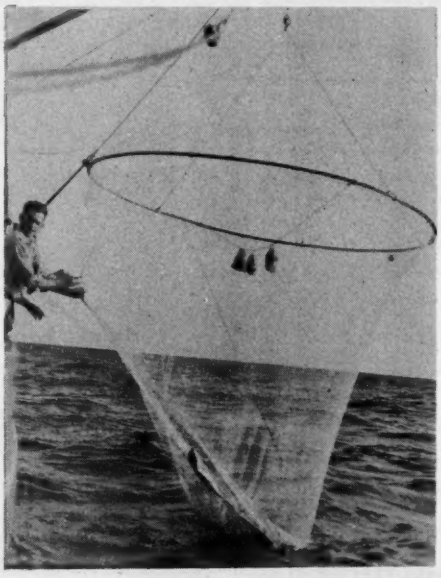


FIGURE 4 - 12 FT. HOOP NET. 3 BAIT BAGS.

One completely mystifying circumstance is that not even one grouper was caught in the 87 hauls, though a number were taken on hand lines to prove that they were not scarce. This must in some way be due to failure in presenting bait properly.

Table 5 shows the catch by hand lines for 80 minutes fishing on November 16 and November 30, 1945. The composite total of all species was 80 fish, taken by four men (average) at a rate of one fish per man every 4 minutes. (These figures should not be taken as representative of hand line fishing generally, for much of the time fishing was on thinly populated bottom where commercial fishermen would not linger.)

Table 5 - Catch by Hand Lines

Date	Time of Day From	To	Total minutes	No. Lines	Snappers	Groupers	Porgies	Leather-jackets	Total fish	Depth Fathoms
Nov.										
16	1130	1150	20	4	9	0	0	0	9	33.5
	1335	1345	10	4	12	0	0	0	12	33.5
	1345	1355	10	5	15	0	0	0	15	33.5
	1355	1405	10	3	9	0	0	1	10	33.5
30	1300	1330	30	4	24	2	8	0	34	37.5
			80	4 av.	69	2	8	1	80	

SUMMARY AND CONCLUSIONS

Both Jarvis and Schroeder in 1931-33, and the author in 1945, were faced with the problem of adapting mass production methods to what is now an obsolete type of fishing vessel. It is the writer's opinion that this problem cannot be solved. Any method which may be used will necessarily be a compromise, and therefore short of the desired efficiency. Early attention should be given to the designing of a 50- to 75-foot diesel powered vessel, able to cruise around 14 knots, equipped with mechanical refrigeration, echo sounding, radio compass, and with comfortable crew quarters.

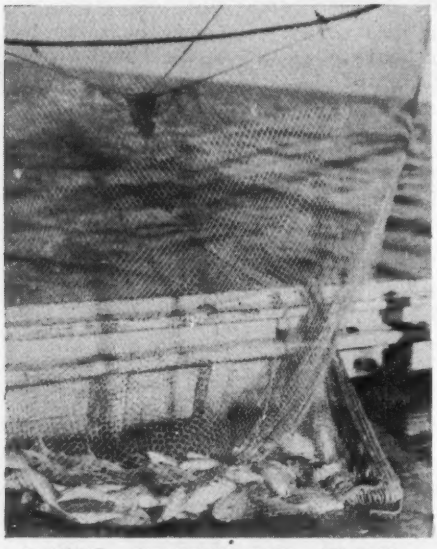


FIGURE 5 - THE RECORD LIFT - 70 FISH

Regardless of the vessel used, if hoop netting is to replace or even supplement hand lining, it must catch more fish or catch the same amount cheaper (Figure 5). The data show that hoop nets had not been developed far enough to equal four fishermen, the nets catching only 357 fish in 565 minutes, while the four men caught a total of 80 fish in 80 minutes.

In view of the incompleteness of the data, the only sound conclusion to be drawn is that the construction, installation, and use of hoop nets on red snapper smacks would not provide a solution to the economic problems. That is; hoop nets, as compared with hand lines, will not produce more fish with the same number of men or an equal amount with fewer, and finally, it will not catch as many fish in the same length of time as four fishermen. The only likely application is by small vessels for catching porgies and other small species on inshore grounds. Its success even there is doubtful, not because of the gear, but because of opposition to using it on the part of fishermen.

TECHNOLOGICAL STUDIES OF THE STARFISH

PART II-CHEMICAL COMPOSITION

By Charles F. Lee*

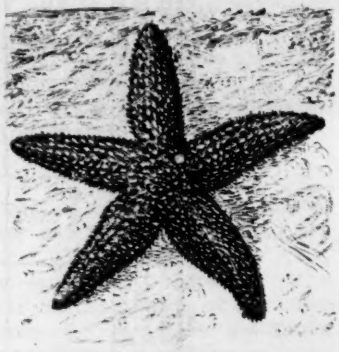
INTRODUCTION

This second section of a series of papers on starfish summarizes all published and available information on the chemical composition of both fresh starfish and starfish meal. The additional information obtained on this subject in the laboratory of the Fish and Wildlife Service is given in detail.

REVIEW OF LITERATURE ON STARFISH COMPOSITION

There are relatively few reports on starfish containing analytical data and those analyses available are, in most cases, not complete. In Table 1, the constituents have been calculated to a uniform basis to facilitate comparison. For example, calcium or calcium oxide are reported as calcium carbonate.

The data are seen to be rather fragmentary, but sufficient to show that starfish are not of constant composition with regard to any single constituent, even when values are calculated on a dry matter basis. Protein, ether extract (fat), and ash with its chief constituent (calcium carbonate), all show a large degree of variation. The data of Hutchinson, et al, (1946) are from an analysis of a small laboratory sample dried at 57° C. (134.6° F.). These values are referred to in several other papers as the composition of the sun-dried meal which was supplied by the Bingham Oceanographic Laboratory group to other laboratories for cooperative studies. That this inference was entirely justifiable is doubtful, as indicated by the check analysis of this same meal reported by Whitson and Titus (1946). Loss of about 10 percent of the protein originally present in the fresh starfish apparently occurred during preparation of the sun-dried meal.



The data of Morse, et al, (1944), also reported in this group of papers, were obtained on a commercially dried experimental batch of four tons of starfish, although the results of their laboratory sample analysis is comparable to data of Hutchinson, et al. A difference equal to 22 percent more protein and 30 percent less ash in the laboratory meal than in the commercial sample is indicated by comparison of these data.

Vachon (1920) emphasizes even more clearly the probable difference between a commercial starfish meal, and a specially prepared sample in the two analyses he reports, one of the material as collected, with seaweed, shells, sand, and other adhering matter as would be used in the practical preparation of large quantities of starfish meal, and the other, the analysis of starfish washed several times and separated from all foreign matter. The value reported for protein in this latter analysis appears to be erroneous.

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NOTE: Part I of this series appeared in the January 1948 issue of Commercial Fisheries Review, pp. 1-6. Also Separate No. 193.

Table 1 - Data in the Literature on the Composition of Starfish and Starfish Meal.

Type of Sample and Reference	Dry Matter	Protein (Nx6.25)	Ether Extract	Crude Fiber	Calcium (as $CaCO_3$)	Magnesium (as MgO)	Phosphorus (as P_2O_5)	Potassium (as K_2O)	Sulfur (as SO_4)	Sand (SiO_2)	Total Ash
Fresh Starfish:	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Wheeler (1913)		11.9			17.2		2.1	0.23			20.3
Galtsoff, et al (1939)	25.12	7.9			10.5	0.57	0.23	0.81			10.9
Hutchinson, et al (1946)		11.3			14.0		0.34		0.87		
Laboratory Dried and Specially Cleaned Meal:											
Kole, C.J. (1919)	87.9	31.6	6.9							3.9	43.9
Vachon, A. (1920)		55.7					1.3	2.42	1.65	0.57	
Hinard & Fillon (1921)		35.62	7.53		47.7						52.95
Morse, et al (1944)	96.89	33.63	7.7	0.4	37.9		1.1				41.7
Hutchinson, et al (1946)[1/]		34.0			42.0		1.0		2.61		
Commercial Type Meal:											
Vachon, A. (1920)		11.0			69.8	3.25	0.70		0.73	3.46	
Galtsoff, et al (1939)	89.9	36.3		1.84							
Morse, et al (1944)	47.9	27.54	5.3								60.13
Whitson & Titus (1946)	94.5	30.7	4.5	1.9	44.0		0.80				30.0[2/]

1/Also Iron - 0.017%, Manganese - 0.0023%, Fluorine - 0.016%, Boron - 0.0034%, Thiamine - 0.0001%, Riboflavin - 0.00053%, Niacin - 0.0038%, and Pantothenicacid - 0.0012%.

2/Ash was ignited at 900°C. - $CaCO_3$ loses CO_2 at 825°C. so figure for $CaCO_3$ is calculated from value for Ca.

Noddack and Noddack (1939) made an extensive spectrographic study of the various metallic elements in a number of marine animals, including starfish. In general, they found greater concentrations of the heavy metals in the animals than in sea water, but quantities were still on the order of one part per billion, with starfish showing the smallest total concentration. Boron was the only element notable in starfish, with 1 to 10 parts per million.

The purified fat of starfish has been reported by Hinard and Fillon (1921) to have a density of 0.9372, an iodine number of 132.7, a saponification number of 159.1, and unsaponifiable matter content of 38.94 percent.

In general, these data from the literature indicate that composition of commercial meals cannot be predicted from analyses of fresh samples of raw starfish. There is, apparently, a loss of about one-tenth or more of the nitrogen present. This could result from a rapid breakdown to soluble products of a portion of the proteins present and their loss in body fluids. Ash is likely to be considerably higher in commercial meals than in laboratory dried meals. This results, in part, from the inclusion of oyster shell, and many other small shellfish, as well as sand and small rocks that are taken in the dredge along with starfish. This variability in analyses is quite evident in data obtained in the present investigation.

MATERIAL

The lack of drying facilities near the source of the starfish at Milford, Conn., made it necessary to ship the starfish, while fresh and perishable, to the College Park Laboratory, some 300 miles distant. As a result of this, the analyses of the fresh starfish cannot be considered representative of the live starfish immediately after catching. However, the data for the meals are a good approximation of what might be expected of commercial meals receiving ordinary care in transportation and handling.

Starfish were obtained at Milford, Conn., by dredging or were hand-picked from mops through the cooperation of a commercial company and the Fish and Wildlife Service Biological Laboratory at Milford. Lots of 50 to 100 pounds were shipped, either in 5-gallon oyster cans or in small, tight, wooden kegs. Samples in the cans were lightly iced, while cool weather alone limited decomposition of the other lots. On arrival at the laboratory, a considerable volume of free liquor was found to have separated in every case. In some lots, the starfish had undergone some decomposition, though most were in good condition, bright colored, and hard.

PREPARATION OF SAMPLES AND ANALYTICAL PROCEDURES

Portions of the liquor on several of the earlier lots were tested for total solids, salt, ash, and organic material. These data are reported in Table 2. The

Table 2.- Proximate Analysis of Liquor Separating from Starfish

Source	Total Dry Matter	Ash	NaCl 1/	Organic Matter	Source	Total Dry Matter	Ash	NaCl 1/	Organic Matter
	Percent	Percent	Percent	Percent		Percent	Percent	Percent	Percent
Lot 1 A	4.63	2.77	2.11	1.86	Lot 2	2.02	1.26	0.95	0.76
" 1 B	4.67	2.63	1.98	2.04	" 3	3.95	2.88	2.42	1.07

1/Total chlorine calculated to sodium chloride.

content of total solids was found to be about 4 percent, of which about 60 percent was inorganic (ash). Sodium chloride calculated from chlorine content constituted approximately 75 percent of the ash. Because of the inadequacy of the available

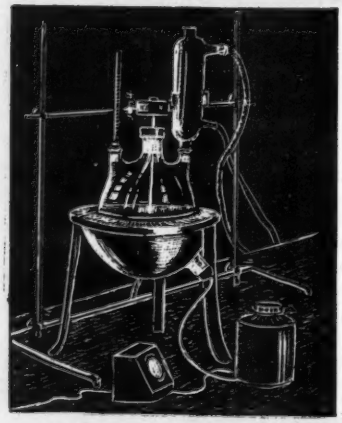
drying equipment and the small amount of organic matter present in this liquor, it was not considered desirable to add it back to the starfish, so the liquor was discarded. The small amount of nitrogen thus lost would not have been retained in usual plant handling practice.

The bulk of the starfish for meal was dried in large galvanized pans in steam heated ovens. The starfish were several inches deep and matted down to a dense layer which retarded drying and the maximum temperature obtained in the oven was 60° C. (140° F.). As a result, complete drying required 5 to 7 days, even when the matted layer was stirred and broken up daily.

In the initial stages of the drying operation, temperatures were sufficiently low to encourage vigorous enzymatic and probably bacterial action. This was desirable since it resulted in a break-down of the exoskeleton of the starfish and greatly facilitated the grinding of the dry meal. It was virtually impossible to grind the tough and hard structure resulting from rapid drying by any means available. Generally, the decomposition was stopped by further drying before it had reached the stage of liberation of ammonia and darkening of the meal, though this did occur in one or two large batches.

METHODS OF ANALYSIS

Dry matter was determined by heating overnight in an air oven, at 105° C. (221° F.). Ash was obtained by ignition of the dry material at 600° C. (1112° F.), until grayish white, and chlorides were determined on the ash by leaching with 1 nitric acid to 3 water and titrating a suitable aliquot by Volhard's method. Total nitrogen (N x 6.25 to give crude protein) was determined by Kjeldahl digestion using copper sulfate as a catalyst. Total organic matter was calculated by difference.



The solvent-soluble portion of the starfish was extractable with ether, but was more readily soluble in acetone. Most of the data on this constituent were obtained from bulk extractions with a Soxhlet type extractor using a mixture of acetone and petroleum ether. The solvent was recovered by distillation and the last portion was removed with aid of a vacuum. Considerable quantities of starfish oil were thus prepared for an investigation of the sterols present in starfish by Dr. Werner Bergmann and coworkers of the chemistry department of Yale University.

In view of the toughness of the starfish "skin," it was thought likely that a chitin-like material might constitute a major portion of the protein present. Chitin was therefore determined on two samples by digestion of the fat-free starfish meal with 20 percent KOH at 60° C. (140° F.) for two weeks. Chitin was determined as the loss on ignition of the dried residue at 550° C. (1022° F.) since the carbonate ash constituted the bulk of the undigested material.

ANALYTICAL RESULTS

The proximate analyses of the meals and some lots of fresh starfish are tabulated in Table 3. Data are not complete on all meals, as several were prepared for special purposes, such as for feeding tests or for the extraction of oil.

All the data for solvent extract except the first value were obtained from bulk extractions, in which the ground meal was placed in canvas bags in the extractor. Caking of the large bulk of meal prevented complete extraction of oil so that these values are perhaps 5 to 10 percent low.

Table 3 - Proximate Analysis of Some Samples of Fresh Starfish and Starfish Meal

Lot	Dry Matter	Protein	Solvent Extract	Total Organic Matter	Chlorides as NaCl	Total Ash
	Percent	Percent	Percent	Percent	Percent	Percent
Fresh Starfish:						
1	35.2		2.7	15.8	2.18	19.4
2	35.0			14.1	1.47	20.9
4	33.6			16.5	1.24	17.1
5	32.6			16.6	1.10	16.0
7	36.0			14.7	1.03	21.3
Starfish Meal:						
1	99.2		7.6	44.4		54.8
2	97.2	27.9	6.9	40.9	2.85	56.3
3	98.7	26.3		39.3	3.81	59.4
4	97.9	29.9	15.1	50.5	3.29	47.4
5	99.1		6.8	42.2	3.73	56.9
6	99.0		8.7	40.1	3.90	58.9
7	99.4		9.3	38.5	3.14	60.8
8	94.9		9.0	36.4		58.5
9	97.2			39.3		57.9
10		28.1				
11		30.6				

Generally, the solvent-soluble material constituted about 7 to 9 percent of the meal. The one high value for Lot 4 of 15.1 percent was obtained with starfish which were full of spawn. As most of the samples were collected in October and November, normally they were spawned out, and this fact may, in part, account for the lower values for protein, as well as oil, and higher ash content than have usually been observed for this species. This particular meal from Lot 4 was the only one to have an ash content under 50 percent. The others ranged from 55 to 61 percent ash, in spite of the fact that an effort was made to pick out most of the shell and foreign matter before drying.

The protein content, as noted before, is lower than some values previously reported, five meals averaging 28.6 percent. Seasonal differences, loss in liquor, and loss during drying may all have contributed to make these low values. The data did not cover a long enough period of time to permit evaluation of all the factors involved in the variable composition of the starfish.

It is evident from the data that the meal dries readily even at the low temperatures used, several meals containing less than one percent water. The starfish before drying contained about 35 percent dry matter, compared to the value of 25 percent reported usually used as a meal factor for freshly caught starfish, indicating a loss of about 10 percent of liquor which separated in transit. Salt content of the meals is well within the permissible limits for fish meals. Chitin content, representing indigestible protein, was found to be low, only 0.55 percent of the dry meal.

The unsaponifiable portion of starfish oil has been examined, particularly in regard to the sterols present, by Bergmann and coworkers. In a preliminary report, Bergmann (1937) had reported that the sterol of starfish, named stellasterol by Kossel and Edlbacher (1915) was a mixture of two or more sterols which were extremely difficult to separate. This sterol mixture, as well as the alcohol, astrol, were present in Asterias forbesi.

This work had been halted by lack of sufficient material until 1942 when the College Park Laboratory supplied Dr. Bergmann with about 12 pounds of oil to permit further investigation.

In 1943, Bergmann and Stansbury reported that the alcohol in starfish oil called astrol by Kossel was identical with batyl alcohol, previously observed in liver oils of sharks and rays. Batyl alcohol is glycerol - 1-octadecyl ether. The structural formula is thus: $CH_3(CH_2)17.O.CH_2.CHOH.CH_2OH$.

In 1944, in a second report on the sterols of starfish, Bergmann and Stansbury had not yet succeeded in complete separation of the sterols. Much had been learned of their molecular structure, however, by selective hydrogenation of the mixture and by other means. The two sterols, tentatively called stellasterol and stellastenol, apparently differed only in the presence of two double bonds in the former, while stellastenol had only a single double bond. Both were slightly dextro-rotatory in contrast with all other animal sterols, therefore, they must lack C 5-6 double bond linkage, having instead a double bond at the Carbon 8. Some of the difficulties in separation and purification of the sterols are thought to be due to a shifting of this double bond from the gamma or delta to the alpha isomer.

These sterols are the first of the principal unsaturated sterols of 28 carbon atoms to be reported in animal tissues. Saturated stellastenol was apparently isomeric with campestanol.

In a more recent publication, Bergmann, et al, (1945) suggest that recent observations support a hypothesis that stellasterol when hydrogenated yields a mixture of campestanol and a 24-carbon atom isomer, and that the starfish sterols are mono- and di-unsaturated derivatives of campestanol, the second double bond being in the C 22-23 position. Some sponge sterols are also related to this compound.

The general study of the sterols of marine invertebrates, contrasting in its complexity with the simple sterol make-up of land animals, is of considerable theoretical interest, especially in connection with theories of the origin of sterols in the body tissues.

NITROGENOUS CONSTITUENTS

The present investigation did not include a study of the amino acids present in starfish proteins. The separation and identification of amino acids was a problem of too great complexity to approach with the personnel and the methods available. In recent years, however, there has been a rising interest in amino acids as special dietary supplements, in medicine, and in nutrition research.

Kossel and Edlbacher (1915) made the only study of amino acids in starfish reported in the literature, and they found taurine in the free state in the sexual organs. Glycine, tyrosine, and glutamic acid were isolated from another fraction of the hydrolysate, while sarcosine, leucine, isoleucine, and proline were also identified. The monoacids, not precipitated as phosphotungstates, accounted for 39 percent of the total nitrogen of the dibasic amino acids. An arginine content of 19.4 percent and lysine content of 11.5 percent were most prominent. Also noted was a small amount of a "histidine fraction." This work was part of an extensive chemical study of starfish, and does not represent any attempt to work out practicable methods of separation. The possibilities for preparation of the various amino acids from starfish, as well as other marine products or byproducts remains virtually unexplored.

It is quite probable that this phase of the utilization of starfish will be emphasized in further investigation of starfish now being considered. The study may be simplified by use of the recently developed microbiological methods for the assay of many of the amino acids, and may result in development of a much more profitable outlet for a product from starfish than the meal and fertilizer preparations hitherto studied.

CONCLUSIONS

The data on the composition of starfish show that the fresh material will yield about one ton of meal per four tons of raw material. The commercial meal contains about one-half as much protein as the common commercial fish meals, but compares favorably in this respect with meals prepared from crab or lobster scrap, shrimp bran, or meals from mussels or other of the less desirable shellfish.

The meal is high in calcium carbonate, while potassium and phosphorus are disproportionately low. Starfish oil contains batyl alcohol, and two newly discovered sterols with 28 carbon atoms related to campesterol. The protein of starfish contains some of the essential amino acids and appears to be a more probable source of a valuable extractive than is the oil fraction.

The use of starfish meal as a protein supplement in rat and chick growth tests and in laying mashes will be reported in a third paper of a series on the utilization of the starfish, Asterias forbesi.

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HOW TO COOK OYSTERS

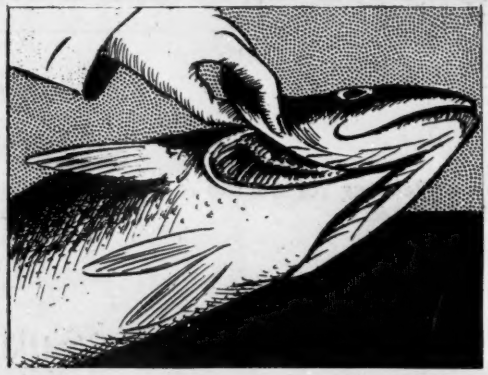
Oysters have a special appeal to the busy homemaker because of the ease with which they are prepared--no waste from trimmings, entirely edible, and easy to serve. They can be served either raw on the half shell, as a cocktail, or cooked in a variety of ways such as stews, chowders, baked, broiled, fried, creamed, scalloped, or in combination with cheese, bacon, celery, spinach, rice, and as a stuffing for poultry. To retain the delicate, distinctive flavor of oysters, never cook them too long, just enough to heat them through and leave them plump and tender.

--Test Kitchen Series No. 3

DECEMBER 1947

Boston, Mass.

As the result of an industry request, an informal meeting of eight technologists from four companies in Boston and Gloucester was held at the laboratory to discuss the general subject of fish quality. Discussions pertained primarily to bacterial spoilage of fish on the vessels, at the point of landing, and in processing plants. Work underway at each company laboratory was explained and discussed. The need for a reliable freshness test for fish was brought out and it was agreed that additional fundamental research was needed on the bacteriology of fish landed in New England ports so that suitable methods for preventing spoilage and developing freshness tests could be worked out. A review of the literature on the subject of bacterial flora of fish is to be presented at a subsequent meeting. The group expressed the desire that the meetings be held at frequent intervals and that members report on subjects within their specialties.



College Park, Md.

Recipes using rosefish, whiting, pollock, and fish meal were developed or tested.

* * *

The amino acids arginine and lysine were found to be present in commercial Alaska salmon meal in nearly equal quantities--2.90 percent for arginine and 2.85 percent for lysine.

* * *

Preliminary determinations of tyrosine as a measure of enzyme activity, using the Beckman spectrophotometer were made in an attempt to develop this more

direct and accurate method as a replacement for the Folin-Ciocalteau color reaction method.

* * *

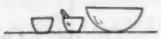
A staff member presented an informal talk on canning methods and sanitation for the fishery sections of the Tri-state Packers Association and acted as judge at its cutting of canned fishery products.

* * *

A demonstration and lecture on fish canning was given to the bacteriology class of the University of Maryland.

* * *

A meeting was attended with Area Home Economists of the U. S. Department of Agriculture in which the subject of a round table discussion was "The Use of Fish in School Lunches."



Ketchikan, Alaska

Recipes for shrimp and for canned whole and minced razor clams were developed and tested.

Seattle, Wash.

Material for the first issue of Commercial Fisheries Abstracts was completed and submitted to the Washington office for publication.

* * *

Part II of the paper, "What's Happening to Vitamin A," was written for publication in a local newspaper.

* * *

After eight months of storage, rockfish fillets with the surface layer of fatty flesh left on, as in the usual procedure, were much inferior in appearance and flavor to fillets which had had the fatty flesh removed by a skinning machine.

* * *

After 16 weeks in frozen storage, Alaskan king crab packed in either tin or cellophane appeared equally satisfactory in flavor and texture. Samples packed in one percent brine were judged slightly superior in texture, while those packed with access to air had inferior texture. All samples were edible but lacked the normal fresh flavor. Whole frozen raw crab legs were very unsatisfactory in texture and appearance. Whole frozen cooked crab legs were much superior.

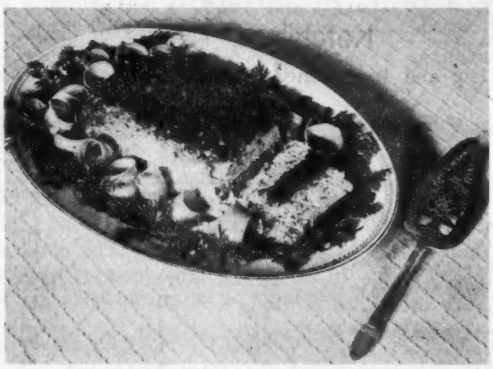
* * *

Part I of the Alaska Salmon Cannery Waste Report was completed and is now available for distribution.

* * *

Yellowfin and flathead flounder fillets were cut from whole fish 10 weeks after freezing. After 14 weeks of frozen storage, these were superior in appearance, flavor, and texture to fillets prepared and stored in the usual manner.

ROSEFISH LOAF



4 cups cooked flaked rosefish
3 cups soft bread crumbs
¾ cup milk
2 eggs, well beaten
1½ tablespoons minced parsley
1 tablespoon lemon juice
1½ teaspoons salt
3 tablespoons butter or fortified margarine
Few grains cayenne
2 tablespoons onion, grated
⅛ teaspoon celery salt

Boil rosefish fillets until done, cool, and flake. Combine all ingredients, mixing well. Place in a greased loaf pan. Bake in a moderate oven, 350° F., for 40 to 45 minutes, or until loaf is firm in the center. Unmold on a hot platter and garnish with celery tops and carrot curls or serve with a rich, bright-colored sauce. Serves 6.

Additions to the Fleet of U.S. Fishing Vessels

Seventy-four vessels of 5 net tons and over received their first documents as fishing craft during December 1947, bringing the total additions to the fishing fleet to 1,299 for the year. During December, the States of California and North Carolina led in number of craft documented with 10 vessels each, followed by Florida with 9 vessels, and Texas with 8 vessels, according to information received from the Bureau of Customs, Treasury Department.

The documentation of fishing craft during 1947 was greater than any previous year for which data are available. During the years from 1936 to 1939, inclusive, an average of about 376 vessels received their first documents as fishing craft annually. This is only 29 percent of the number of vessels documented in 1947. During the three years 1945, 1946, and 1947, a total of 3,125 vessels received their first documents as fishing craft, an average of 1,041 each year. In 1940, the total number of fishing vessels of 5 net tons and over in the domestic fishing fleet numbered only 5,562.

Vessels Obtaining Their First Documents as Fishing Craft

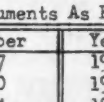
Section	December		Twelve mos. ending with December	
	1947	1946	1947	1946
	Number	Number	Number	Number
New England	5	4	75	86
Middle Atlantic	3	2	70	74
Chesapeake Bay	7	5	97	71
South Atlantic and Gulf	34	29	490	351
Pacific Coast	14	20	411	375
Great Lakes	3	4	74	76
Alaska	6	1	47	19
Hawaii	2	4	23	17
Unknown	-	-	12	16
Total	74	69	1,299	1,085

Note: Vessels documented by the Bureau of the Customs are craft of 5 net tons and over.

Vessels Obtaining Their First Documents As Fishing Craft, 1936 to 1947, Inclusive

Year	Number	Year	Number	Year	Number	Year	Number
1936[1/]	435	1939	357	1942	358	1945	741
1937	335	1940	320	1943	358	1946	1,085
1938[1/]	376	1941	354	1944	635	1947	1,299

1/Data are partly estimated.



Dr. Finn Addresses Conference at Quebec

The need for the development of the world fishing industry was emphasized by Dr. D. B. Finn, Director of the Fisheries Division of FAO, at an East Coast Fisheries Conference in the Chateau Frontenac, Quebec City, on February 3, according to an FAO release.

"The best figures obtainable show that the population of the world in 1938 was 2,172 million," Dr. Finn said. "In the short period to 1946, this figure has risen to 2,295 million; that is, an increase of 5.7 percent. It is estimated that, if the present trend continues, the population of Asia alone would increase by 400,000,000 during the next 20 years."

Particularly in Asia, Dr. Finn pointed out, where nutritive standards are very low, population pressures already limit the effectiveness of agricultural production, and it is unlikely that even improved methods of irrigation will enable the agriculture of that area to supply the protein foodstuffs needed to cope even in a minimum way with the increase in population. On the other hand, they have the sea, whose richness for the most part is unmeasured, and a technology which is relatively undeveloped.

To stimulate and guide the work of assessing and managing the resources of the sea, FAO proposes to set up a number of regional councils and the first of these will be a council for the Indo-Pacific Ocean. On February 23, representatives of governments concerned will meet at Baguio, in the Philippine Islands, to initiate this council, whose first function will be to collect information about the resources of the area with a view to focusing the attention of member governments on the further development and wise use of the fisheries.

Fishing Research Boat to be Commissioned

Secretary of the Interior J. A. Krug on February 19 announced that the commissioning and dedication of the Albatross III, the only ocean fisheries research vessel operating out of the United States, will take place on March 19, at Boston, Mass.

The vessel, a 167-foot converted commercial trawler, recently completed her sea trials and then returned to the shipyard for minor adjustments. The Albatross III is powered with an 800 horsepower diesel engine and is equipped with the latest developments in navigation aids.

The ship will be stationed at the United States Fisheries Laboratory at Woods Hole, Mass., her home port, and will be operated by the Fish and Wildlife Service in North Atlantic waters.

Imports of Fishery Products from Japan, 1947

Trade with Japan was resumed during 1947. However, imports of fishery products to the United States did not start until November 1947, when 247,885 pounds were entered. Crab meat accounted for 241,765 pounds of this total.

Of the 411,759 pounds received from Japan during December, crab meat was the leading item with 133,778 pounds. Some of the other items were fresh and frozen scallops, 5,000 pounds; other shellfish, 74,056 pounds; whole fish, fresh and frozen (does not include fresh-water fish, eels, halibut, swordfish, tuna, or sturgeon), 60,040 pounds; fish, filleted, sliced, or divided (mainly swordfish), 12,079 pounds; and fish roe (not boiled), 33,940 pounds.

Notes on the Fisheries of Maryland

Cold weather--one of nature's forces--got to work in January. During two weeks of continued low temperature and persistent snow and ice in the latter part of the month, oystering activities ceased almost completely. Prices for both shell and shucked stock rose, even though there had been no post-Christmas slump. Oystermen in the Choptank River resorted to a method of oystering that is seldom necessary. With all their boats locked solidly in ice, and oyster houses eager for shucking stock, a hardy group of men took a dredge out on the ice, cut a hole to lower it through and a narrow channel to pull it in, and, by using manpower alone, were able to harvest a satisfactory catch.

The immobilization of the oyster fleet was general throughout the State. It was possible to get some shellstock from Virginia, but it arrived mostly frozen and cost more than packers could afford to pay if they were to keep their shucked product on a competitive level. In the face of this, almost all shucking houses in Maryland shut down.

Winter operations for fin-fish were restricted because of danger to nets from ice. Striped bass, one of Maryland's winter standbys, were scarce and brought 40 cents to 50 cents a pound in the Baltimore market. Medium croakers brought 20 cents, and the poor supply was giving many a dealer thoughtful pause.

Crisfield's soft crab freezing industry has become more important than just a side line. Approximately 15 firms have been packaging and freezing soft crabs during 1947. The crabs are frozen both in the round and ready for the pan, with dealers favoring the former. Freezing of soft crabs, for distribution during all 12 months of the year, may minimize the wide price fluctuations which regularly occur in this branch of the fishing industry.

The Maryland Department of Tidewater Fisheries declared winter crab-dredging legal in Chincoteague Bay as of November 15, 1947. The dredgers who rigged up for

it, have already laid by their equipment and switched to other pursuits because of the scarcity of crabs.

A preliminary investigation of fish waste in Maryland was made by the Department of Research and Education at Solomons Island, Md. The discarded materials, ranging from oyster liquor to alewife milt, were listed and their salvage value pointed out in a recently published report entitled "Utilization Plan--Maryland Marine Products." Chemical companies and other manufacturers were invited to test such waste for yields of pharmaceutical substances and to assist in making recommendations for the use of available waste products.

Office of International Trade Reorganized

Announcement of the reorganization of the Office of International Trade was made recently by the Department of Commerce, the purpose of the reorganization being to coordinate and amalgamate the export control functions of the former Export Supply Branch with other functions of the Office of International Trade. In this way, the full resources of the Office of International Trade can be channelled more effectively to develop and implement special programs made necessary from time to time by changing world conditions. Increasing emphasis is being placed upon export control as a means of distributing essential commodities to the most needy areas. Therefore, the Export Supply Branch was abolished as an independently operating part of the Office of International Trade; its functions, together with all others relating specifically to commodities, were combined under a single Commodities Division; and additional responsibilities were placed in the existing Areas Division.

The Office of International Trade now consists of the Office of the Director, the Areas Division, the Commodities Division, the Export Operations Division, and the Intelligence and Services Division.

The Commodities Division has the responsibility of processing export license applications and has also been charged with new duties in helping to carry out the export control program.

Applications for export licenses should continue to be addressed to the Office of International Trade, Washington 25, D. C.

Wholesale and Retail Prices

The wholesale price index for food showed an increase of 0.6 percent by the middle of December. This is a reversal in the trend which had been down for the past two months. The retail index number for all foods, which had remained nearly steady for two months, showed an increase of 2.1 percent. This was the largest increase in any one month since March 1947. The average retail price for the principal varieties of fresh and frozen fish in 56 cities of the United States declined 1 percent between November 15 and December 15. The price of canned pink salmon also in these same cities increased, according to the Bureau of Labor Statistics, U. S. Department of Labor.

Wholesale and Retail Prices

Item	Unit		Percentage change from--	
Wholesale: (1926 = 100)		Dec. 13, 1947	Nov. 15, 1947	Dec. 14, 1946
All commodities	Index No.	161.4	+1.8	+15.5
Foods	do	179.0	+0.6	+11.0
Fish:		Dec. 1947	Nov. 1947	Dec. 1946
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	4.95	+1.2	+55.0
Red, No. 1, Tall	do	6.279	0	+17.0
Cod, cured, large shore, Gloucester, Mass.	$ per 100 lbs.	14.5	0	0
Herring, pickled, N. Y.	¢ per lb.	12.0	0	0
Salmon, Alaska, smoked, N. Y.	do	35.0	0	0
Retail: (1935-39 = 100)		Dec. 15, 1947	Nov. 15, 1947	Dec. 15, 1946
All foods	Index No.	206.9	+2.1	+11.3
Fish:				
Fresh and canned	do	302.3	0	+13.0
Fresh and frozen	¢ per lb.	42.9	-1.0	0
Canned salmon:				
Pink	¢ per lb. can	51.3	+1.4	*

*Inadequate information.

THE "BOB" METHOD OF PICKING BLUE CRABS

The "Bob" method of crab picking is a rapid way of separating the meat from the shell and is so named because all the legs of the crab are "bobbed" or cut off before the actual picking is begun. It is a method which has been used with good results in some localities for more than a quarter of a century.

Separating the meat from the shell of the crab is still difficult chiefly because of the peculiar anatomy of the crab. Its many shaped body chambers and size variations have steadily resisted efforts to simplify, mechanically, the procedure. Therefore, an efficient picking method is one of the principal factors in a successful commercial operation.

--Fishery Leaflet 276

FOREIGN

Burma

NEW DEEP-SEA FISHING COMPANY: A company has been formed to utilize one of Burma's greatest natural assets, her very long coast line, which places her in an extremely advantageous position to explore the possibilities of deep-sea fishing, according to an article in the New Times of Burma of January 13, 1948, as reported by the American Embassy at Rangoon.

The company in question has already acquired two deep-sea refrigerated trawlers, each of 58 tons deadweight and 30 tons capacity, equipped with wireless and the latest mechanized fishing equipment as well as a floating cold storage of 100 tons capacity. Its headquarters will be at Mergui and the trawlers will operate mainly off the Tenasserim Coast.

The company has been formed with the object of providing fish to the people of Burma at a greatly reduced figure and later to explore the possibilities of fish byproducts; viz., fish fertilizer and meal, extraction of oil and fish maws (sounds) both for local consumption and export to the United Kingdom, Australia, and America, from which countries enquiries have already been received.

The Burmese as a nation have always shown a distinct preference for fish in their daily diet, and it is a matter of common knowledge that fish ranks second only to rice in the national diet and that no meal in a Burmese house is complete without fish.

Canada

SEA FISHERIES--1947: According to a preliminary review of the sea fisheries for the calendar year 1947, by the Dominion Bureau of Statistics, landings amounted to 1,093.7 million pounds, a decrease of about 10 percent from the 1946 total. These landings were valued at $46,038,000, a decline of about 17 percent from the previous year's figure.

The decline in production in 1947 occurred in the fisheries of the Atlantic Coast, where landings were 20 percent by volume and 33 percent by value below those of 1946. The most serious decline took place in the cod fishery. Landings of that species fell off by more than 100,000,000 pounds from the 1946 total of 312.5 million pounds. About one-quarter of this loss was incurred during the

tie-up of the deep-sea fishing fleet at the beginning of 1947. The greater part of the loss, however, is attributable to a sag in the U. S. market for frozen fillets early in the year. This resulted in a drop in the price for raw cod which remained effective during the height of the fishing season and caused numbers of fishermen to withdraw from this fishery in certain districts, notably in the Gaspe area, and otherwise greatly reduced the fishing effort. The value of the 1947 landings of cod was less than half that of the 1946 catch.

Landings in the other great Atlantic fishery, that of lobsters, also showed a decline, but this is attributable to adverse fishing conditions.

The important Pacific Coast fisheries--salmon, herring, and halibut--all showed increases in both quantity landed and value during 1947. In volume, landings totaled 474.8 million pounds, and in value, $23,199,000, representing increases of 8.5 percent and 6.3 percent, respectively. (Because of a smaller catch of sockeye salmon, a high priced item, over-all value increased less than total volume of landings.)

As to disposition of the catch, perhaps the most significant development on the Atlantic Coast was the drop in the production of cod fillets. A large part of the decrease in cod landings is accounted for by the reduced requirements of the filleting plants. The quantities of cod salted and canned showed slight increases. There was also a substantial increase in the production of canned sardines in 1947. On the Pacific Coast, the only significant change in disposition was an increase in the quantity of herring canned. The disposition of the salmon catch between the fresh markets and the canneries appears to have been fairly normal.

Iceland

FOREIGN TRADE IN 1946: Iceland, with an area of around 40,000 square miles, is approximately as large as Ireland and had a population, in 1947, of 132,750, of whom 51,011 lived in Reykjavik, the capital. The 1940 census gave the following occupational distribution:

Agriculture - 30.6%	Fisheries - 15.9%	Business - 7.2%	Civil Service - 5.8%
Industry - 21.3%	Communications - 8.7%	Personal Services - 5.3%	Nonworkers - 5.2%

Fishing and agriculture are the two major industries of Iceland. In 1946, the total fish catch amounted to 368,000 tons, a total below average because of the failure of the herring season, which amounted to only 131,700 tons. The herring yielded 19,470 tons of oil, 19,724 tons of meal, and 4,188 barrels of salted herring, while the other varieties of fish were processed as follows:

Iced - 44.7% Frozen - 37.1% Salted - 16.1%

Small quantities were also dried or canned and a relatively small amount was consumed in Iceland.

The unit of currency is the Icelandic crown (krona) of 100 aurar. At the present official rate of exchange, 6.4727 Icelandic crowns equals $1.00 United States currency.

Rigid measures of exchange control are in force, particularly in the use of dollars. All imports require an exchange permit for payment to the foreign supplier.

Iceland is served by three banks, one of which is the Fisheries Bank which specializes in fishing, industry, and commerce.

Iceland imports a great variety of manufactured goods, raw materials, and foodstuffs, and exports fish, fish products, furs, hides, skins, wool, and meat. Exports in 1946 amounted to $45,000,000, and imports to $68,000,000. Of the total exports, 36 percent went to Great Britain, 20 percent to the Soviet Union, 13 percent to the United States, and 14 percent to Denmark and Sweden combined. Of the total imports, 37 percent were supplied by Great Britain, 25 percent by the United States, and 20 percent by Sweden and Denmark combined. Machinery and electrical equipment, food, raw materials, and textile products were among the chief exports from the United States; coal, cement, salt, and petroleum fuels were the major import items from the United Kingdom. From Sweden and Denmark came chiefly machinery. Most of Iceland's imports of grain came from Canada.

Exports of Fishery Products from Iceland

Fish Exports	To all countries		To United States only	
	Metric Tons	Value in Crowns	Metric Tons	Value in Crowns
Fish on ice	72,699	62,010,530	-	-
Frozen fish	23,998	60,979,340	2,986	8,098,000
Cod liver oil	7,745	28,482,450	5,922	21,999,000
Salted herring	158,662 bbls.	27,979,660	9,638 bbls.	2,126,000
Herring oil	17,534	26,787,670	-	-
Saltfish, uncured	10,908	17,849,430	-	-
Herring meal	10,195	7,972,120	3,381	3,008,000
Fish meal	6,169	4,079,030	1,534	1,112,000
Canned fish	514	2,875,000	289	1,477,000
Salted roe	14,723 bbls.	2,693,390	269 bbls.	85,000
Saltfish, in barrels	625	1,039,110	-	-

An ad valorem export duty is levied on the f.o.b. prices of exports as follows:

Salt herring 3.75%
Other fish products 2.25%
All agricultural products ... .100%

A reciprocal trade agreement between the United States and Iceland provides for reciprocal most-favored-nation treatment and certain tariff adjustments.

The capacity of Iceland as a purchaser of foreign goods is limited to its ability to find external markets for its produce. Consequently, in ratio to available currency, limitations are imposed on imports from different areas. Importers must obtain import licenses before placing orders, or their merchandise may not be allowed to enter the country. Consular invoices are not required.

Japan

ARMY LIFTS QUOTA ON TRADERS: The lifting of over-all and national quotas for private traders and announcement that applications for entry into Japan may be submitted by persons wishing to seek restitution of their property or to investigate the possibilities for private investment, was announced on February 3 by General MacArthur's headquarters in Tokyo and the Department of the Army in Washington.

All entrants must be sponsored by their respective governments and approved by the Supreme Commander for the Allied Powers as having business interests which will contribute to the rehabilitation of the Japanese economy.

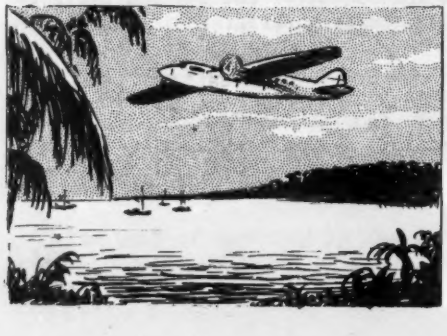
The existing 21-day limitation on visits of private traders in Japan has been expanded to an initial period of 60 days for all persons who wish to enter Japan. During this period, those who wish to remain longer, provided they meet certain requirements, may apply for a semi-permanent resident's permit.

It was emphasized that the new entrance criteria do not alter existing regulations governing procedures for transacting business, or types of business activity permitted in Japan. Foreign trade still must be transacted through Boeki Cho, the Japanese Government's official Board of Trade, and contracts must be validated by SCAP.

Norway

WHALING TREATY: A Norwegian Government proposal recommending ratification of the International Whaling Agreement for the control of pelagic whaling has been forwarded to Parliament. The Foreign Ministry noted that the agreement was regarded as satisfactory and that the limitation of whaling is a prime condition for the continuation of pelagic whaling in the Antarctic areas. The statement added that whaling nations should be fully aware that it may soon be necessary to impose a further limitation on the number of whales caught, in the interest of whale conservation, and that preparation should be made accordingly.

Venezuela



SHIPPING FISH BY AIR: The first commercial shipments of fish by air in Venezuela was started on January 22, according to a report from the American Embassy at Caracas. The first cargo of 10,900 pounds of iced fish were carried in a Catalina ship from "Los Roques" in the Venezuelan Islands to Caracas, a distance of about 100 miles.

As there has been a local fish famine in and around Caracas for several weeks,

the fish was all sold by noon of the day of arrival. Red snapper and Spanish mackerel sold 4 bolivares per kilogram (55 cents per pound); grouper, at 3.50 bolivares (84 cents); and grunts, at 2.75 bolivares (37-2/3 cents).

At present, flights are expected every 2 or 3 days, but if the market demand improves, a second plane will be added.

FUNCTIONS OF THE FOOD AND AGRICULTURE ORGANIZATION

There is in some quarters, I find, a misunderstanding of the Food and Agriculture Organization's functions and the job that it can do. I find that in the minds of some people there was the thought that this Organization, whose Constitution sets forth its aims in terms of the ideal, could immediately and henceforth become responsible for all the work of righting all the wrongs that occurred in food matters and world trade. Some people thought that it was another UNRRA and would have vast sums of money to spend in food relief, in farm machinery, and other equipment. Others thought that it would be a super national authority which could order the affairs of nations and override their sovereignty.

These, as we know, are mistaken conceptions. As a matter of fact, FAO's position may be likened to that of the engineer and the architect, but not that of the owner. The engineer gathers all available data concerning the problem and points to gaps in knowledge. He applies the existing scientific facts to a particular purpose. The architect uses the knowledge furnished by the engineer to design a structure to satisfy a human need. But it is the owner who is responsible for the actual construction based upon that design. FAO is the engineer, the architect, the consultant. Nations and countries themselves are the owners. It is on this concept that FAO works. It assembles available knowledge and converts it into a uniform terminology. It assists in applying this knowledge to a particular purpose or design and it will probably go further where necessary by helping countries with education and skilled advice during the work on the actual construction or utilization.

--Address delivered by Dr. D. B. Finn,
Director, Fisheries Division, FAO,
At the East Coast Fisheries Conference,
Chateau Frontenac, Quebec City, on
February 3, 1948.

FEDERAL ACTIONS

Department of the Interior

ALASKA COMMERCIAL FISHERY REGULATIONS, 1948: The new regulations for the protection of the commercial fisheries of Alaska are based upon investigations and recommendations of Fish and Wildlife Service personnel, testimony presented at public hearings conducted by the Service at eight places in Alaska and at Seattle, Wash., and upon written briefs submitted by those interested in the Alaska fishing industry.

A number of changes have been made for 1948 in the general regulations applicable in most sections of Alaska. The predetermined patterns of extensions and curtailments of fishing seasons in Southeastern Alaska, Kodiak, Prince William Sound, and the Alaska Peninsula areas have been eliminated. Flexibility in the fishing seasons will be assured by the delegation of authority to Fish and Wildlife Service personnel in the field to extend or curtail fishing seasons as conditions warrant.

Other changes of general interest provide a minimum weight as well as a minimum length limitation on troll-caught king salmon. No salmon of this species measuring less than 26 inches in length or weighing less than 6 pounds when dressed may be taken commercially under the revised regulations. Minimum limitations have been placed on otter trawls with regard to mesh size, method of operation, and place of operation with relation to immature halibut. Otter trawl operators also are required to submit periodical reports, including catch statistics. Herring catch quotas have been reduced from 400,000 to 300,000 barrels in the Kodiak area, and increased from 350,000 to 400,000 barrels in Southeastern Alaska. The quota of 150,000 barrels for the Prince William Sound area remains the same as in 1947.

In the Bristol Bay area, a good red-salmon run is expected this year, and only minor regulation changes have been made. Opening and closing dates for fishing have been advanced two days to provide an open season from June 28 to July 28 in the Ugashik District, and from June 25 to July 25 in all other districts. These dates were in effect prior to the 1947 season. Additional information is being developed at present with regard to a possible further change in the 1948 regulations to modify the restriction on the use of motor-propelled gill net boats in Bristol Bay.

In the Alaska Peninsula area, seasonal restrictions in effect prior to 1947 have been restored except that the fall season will open on August 20 instead of August 26 in the Port Moller District, and on September 6 instead of August 26 in other waters of the area. In order to restore depleted pink-salmon runs, closed

areas have been extended or established near the mouths of several important spawning streams. Other changes in this area reduce the red-salmon catch quota from 700,000 to 500,000 in waters between Entrance Point and Cape Seniavin, and eliminate an open area for a trap that has not been occupied.

In the Kodiak area, the opening date for salmon fishing in the Karluk and General Districts has been changed from June 1 to June 10 except in waters surrounding Raspberry Island, Whale Island, and Afognak, Marmot, and Shuyak Islands, where the opening date has been delayed from June 1 to July 10 to rebuild depleted red-salmon runs. Elsewhere in the area, seasonal limitations in effect prior to 1947 have been restored. A total of 700,000 red salmon has been fixed as the minimum escapement to Karluk River, of which not less than 350,000 shall be counted through the weir prior to July 15. Closed areas around the mouths of certain pink-salmon spawning streams have been increased to restore runs of this species. Other changes specify an increase in the maximum length of salmon purse seines from 125 to 200 fathoms, and provide seasonal and size limitations for the protection of Dungeness crabs.

The usual even-year seasons for salmon fishing have been provided in the Cook Inlet area, and a uniform closed season on razor clams, from July 10 to August 31, has been established for the area.

In the Resurrection Bay area, the same restrictions on the size and operation of purse seines and leads have been prescribed as those in effect in the adjacent Prince William Sound area. Provision also has been made for the registration of fishing boats operated in Resurrection Bay after the close of the regular season in the Prince William Sound area on August 7.

The opening dates for salmon fishing in the Prince William Sound area have been changed from July 5 in each odd-numbered year and July 10 in the even-numbered years to July 1 and July 20, respectively, and additional closed sections have been designated near the mouths of two important spawning streams.

In order to provide additional protection to depleted red-salmon runs in the Copper River and Bering River-Icy Bay areas, the total weekly closed period for salmon fishing prior to August 10, has been extended from 48 to 72 hours by the addition of a mid-weekly closed period from 6 a.m. Wednesday to 6 a.m. Thursday of each week. During this season, the maximum limitation on the use of red-salmon gill nets also has been changed from 200 fathoms of net per boat to 150 fathoms for any individual.

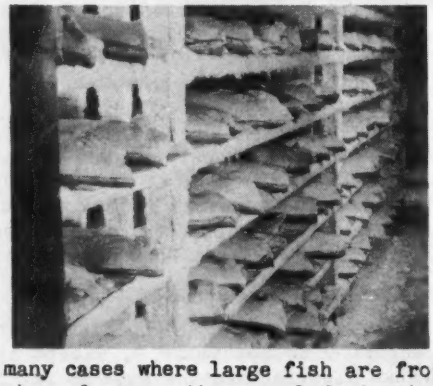
In the Southeastern Alaska area, a uniform season for salmon fishing, other than trolling has been established from August 9 to September 3, except in the Yakutat District. Regulations in the Yakutat District are the same as for 1947. The purpose of the uniform season in most of Southeastern Alaska is to rebuild early pink-salmon runs, particularly in the northern districts of Southeastern Alaska where the seasons formerly opened two to four weeks earlier. A uniform season will reduce, to some extent, the intensity of fishing operations that has resulted in the past from the concentration of gear in each district as the various seasons opened. It has been emphasized that both the opening and closing dates of the uniform season for Southeastern Alaska are subject to revision as the runs progress. Officials of the Fish and Wildlife Service will be authorized, as in past years, to modify seasonal dates in the field whenever such changes are found necessary to permit adequate escapements.

A number of exceptions have been made to the August 9 opening date to permit fishing prior to that time, in certain waters where species other than pink salmon predominate. These sections include Tenakee Inlet, the northern section of Lynn Canal, Taku Inlet and Port Snettishan, the Stikine District, and waters west of a line from Cape Muzon to Cape Ulitka. Fishing boats entering these waters prior to August 9 are required to register with, and report catches to, local agents of the Fish and Wildlife Service.

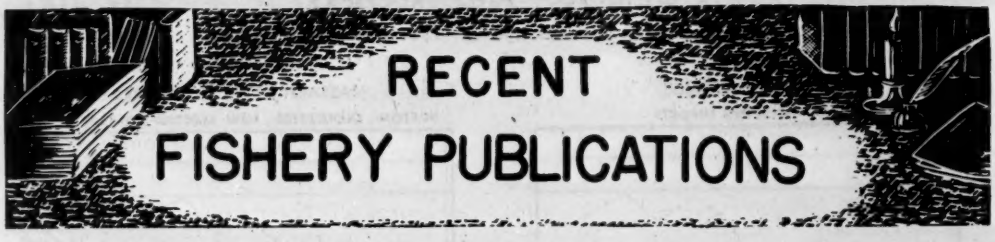
Other changes in the Southeastern Alaska area fix the closed season for shrimp fishing from February 15 to May 1, prohibit trolling throughout the year from Icy Point to and including Lituya Bay, and eliminate six open areas for traps that have been abandoned.

HANDLING OF FROZEN FISH

Fish which are frozen in the round, or those which are too large to be wrapped in moisture-vapor-proof material, should be glazed with a heavy coating of ice to prevent freezer burn or dehydration. In order that the glaze can be maintained it is necessary to examine them in the storage room at frequent intervals to be sure that the glaze has not evaporated. Reglazing should be done as soon as the condition of the glaze indicates it is necessary. Water for this purpose should be as cold as possible without freezing in the sprayer, so that it will freeze almost instantly when sprayed on the cold fish. In many cases where large fish are frozen on expansion coil shelves in a sharp freezer, they are left in the freezer longer than is necessary without the protection of the glaze. This practice often results in serious losses due to freezer burn and actual loss of weight due to dehydration. The correct practice in the case of large fish is to remove it from the sharp freezer and glaze promptly so as to reduce losses to a minimum.



--Fishery Leaflet 286



Listed below are informational publications which recently have been processed by the Division of Commercial Fisheries. These publications are available, free of charge, from the Division of Information, Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D. C.

Number	Title
Sep. No. 193	Technological Studies of the Starfish - Part I--Starfish Control--Its Economic Necessity and Methods Used
Sep. No. 194	Economic Review of the Fisheries in 1947 and Prospects for 1948

Designations for fishery publications are interpreted as follows:

CFS - Current fishery statistics of the United States and Alaska.

FL - Fishery leaflets.

SL - Statistical lists, consisting of lists of dealers of fishery products and manufacturers of byproducts.

MDL - Market development lists of frozen food locker plants and locker associations.

Sep. - Separates (reprints) from Commercial Fisheries Review.

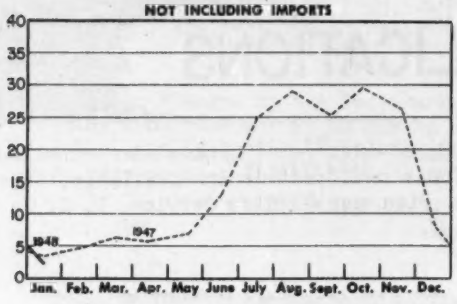
Processing -- Miscellaneous Service Division

Illustrator--Gustaf T. Sundstrom Compositors -- Jean Zalevsky and Norma D. Loeffel

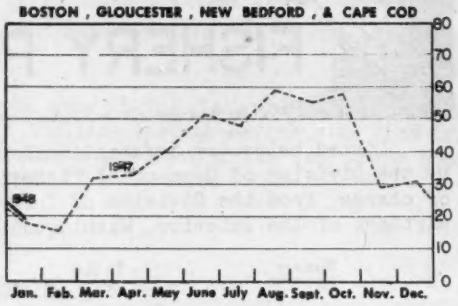
LANDINGS AND RECEIPTS

In Millions of Pounds

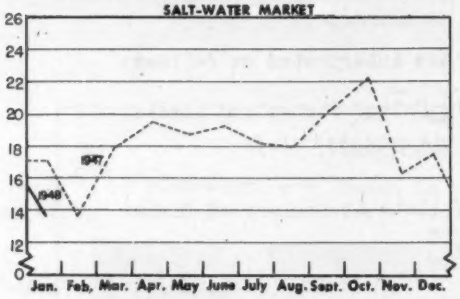
MAINE - LANDINGS
NOT INCLUDING IMPORTS



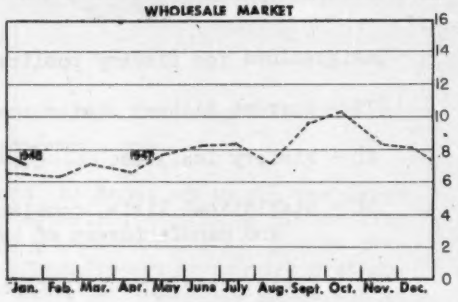
MASSACHUSETTS - LANDINGS
BOSTON , GLOUCESTER , NEW BEDFORD , & CAPE COD



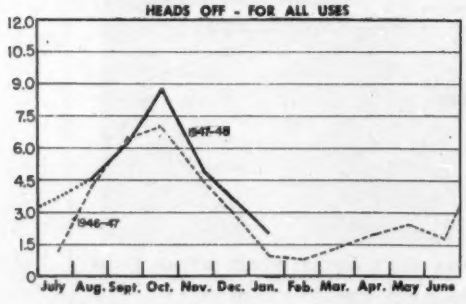
NEW YORK CITY-RECEIPTS OF FRESH & FROZEN FISH
SALT-WATER MARKET



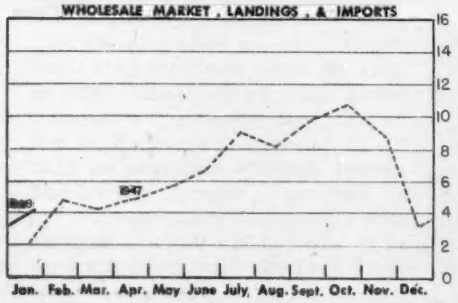
CHICAGO - RECEIPTS OF FRESH & FROZEN FISH
WHOLESALE MARKET



GULF - SHRIMP LANDINGS
HEADS OFF - FOR ALL USES

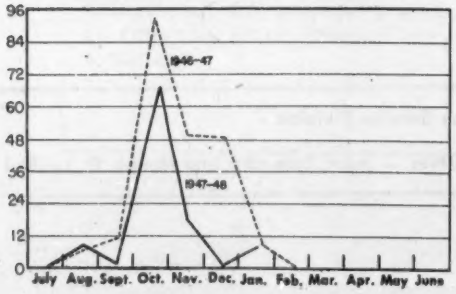


SEATTLE - RECEIPTS OF FRESH & FROZEN FISH
WHOLESALE MARKET , LANDINGS , & IMPORTS

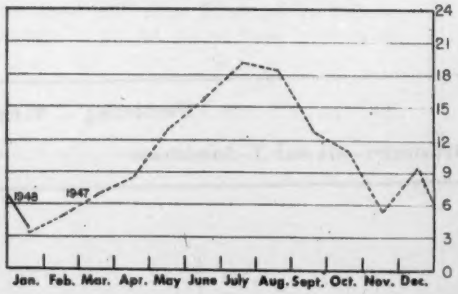


In Thousands of Tons

CALIFORNIA - PILCHARD LANDINGS



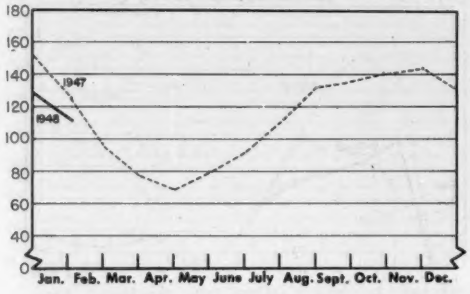
CALIFORNIA - TUNA LANDINGS



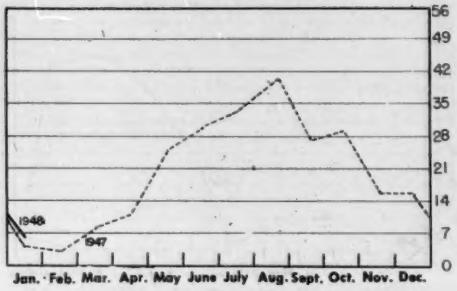
COLD STORAGE HOLDINGS and FREEZINGS of FISHERY PRODUCTS

In Millions of Pounds.

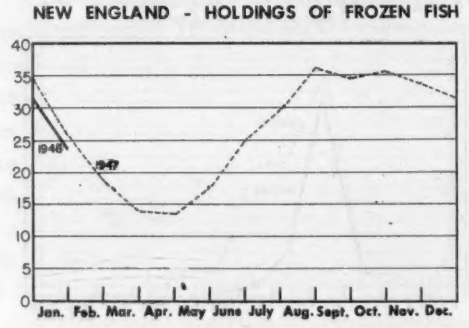
U.S. & ALASKA - HOLDINGS OF FROZEN FISH



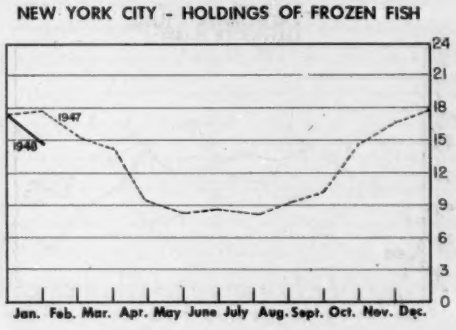
U.S. & ALASKA - FREEZINGS



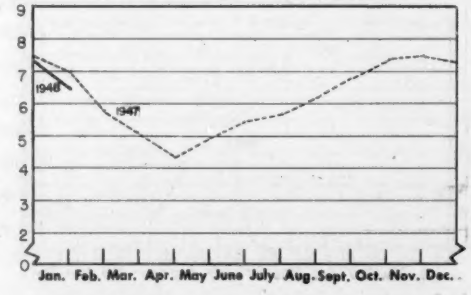
NEW ENGLAND - HOLDINGS OF FROZEN FISH



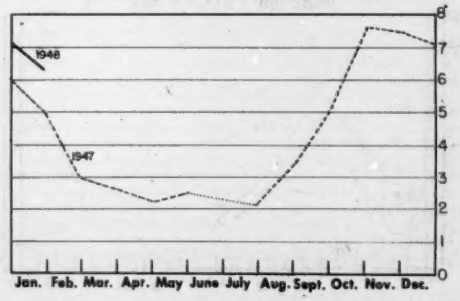
NEW YORK CITY - HOLDINGS OF FROZEN FISH



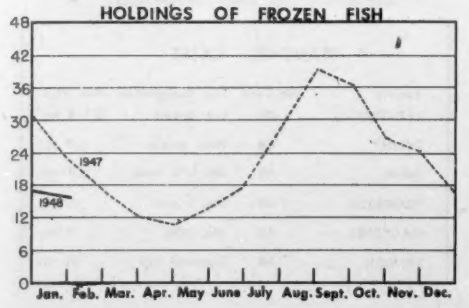
CHICAGO - HOLDINGS OF FROZEN FISH



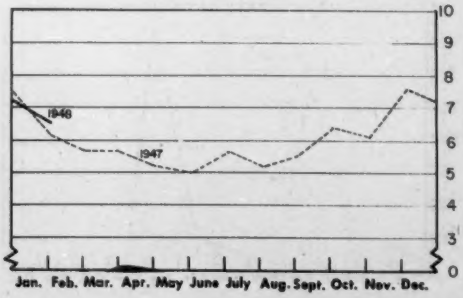
GULF - HOLDINGS OF FROZEN FISH



WASHINGTON, OREGON, AND ALASKA - HOLDINGS OF FROZEN FISH



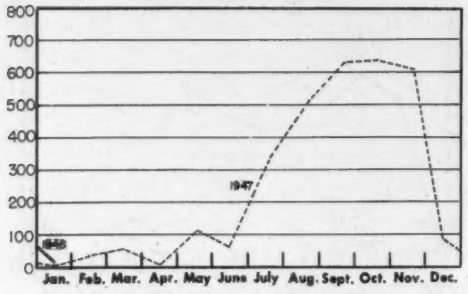
CALIFORNIA - HOLDINGS OF FROZEN FISH



CANNED FISHERY PRODUCTS

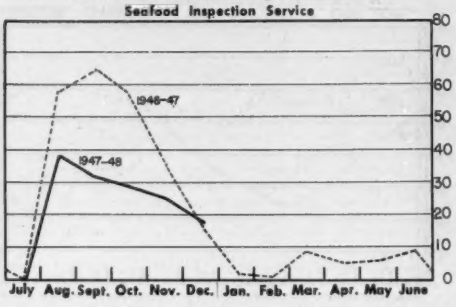
In Thousands of Standard Cases

MAINE - SARDINES, ESTIMATED PACK

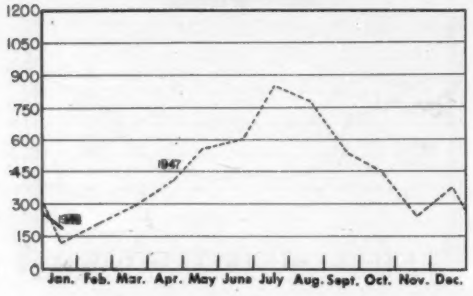


UNITED STATES - SHRIMP

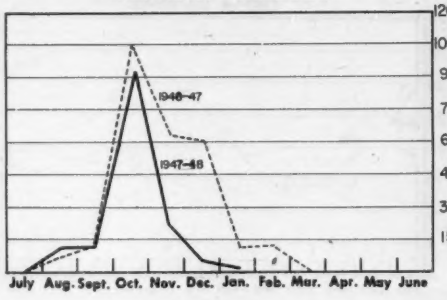
Plants under Food and Drug Administration Seafood Inspection Service



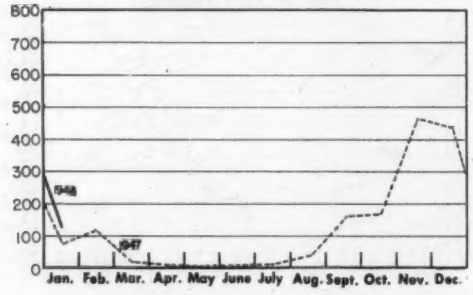
CALIFORNIA - TUNA



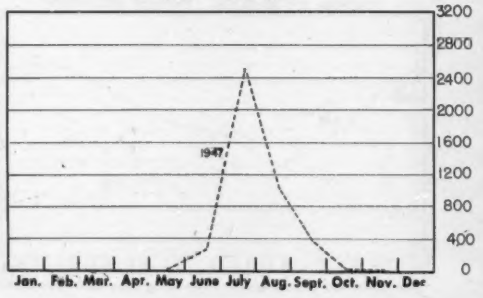
CALIFORNIA - PILCHARDS



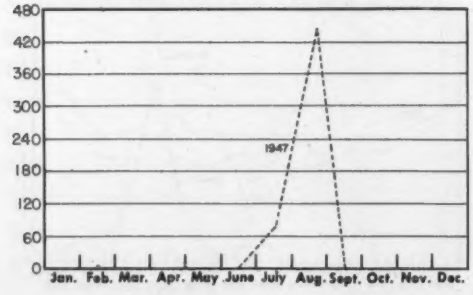
CALIFORNIA - MACKEREL



ALASKA - SALMON



WASHINGTON - PUGET SOUND SALMON

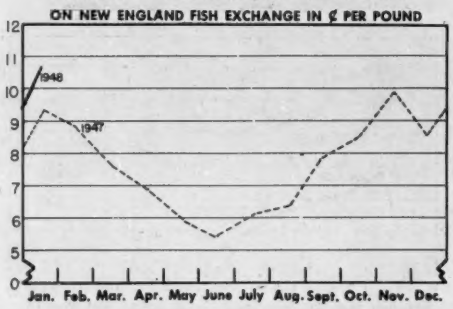


STANDARD CASES

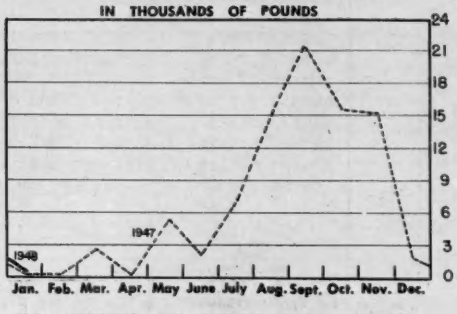
Variety	No. Cans	Can Designation	Net. Wgt.
SARDINES	100	1/4 drawn	3 1/4 oz.
SHRIMP	48	No.1 picnic	7 oz.
TUNA	48	No. 1/2 tuna	7 oz.
PILCHARDS	48	No. 1 oval	15 oz.
MACKEREL	48	No. 300	15 oz.
SALMON	48	1-pound tall	16 oz.

PRICES, IMPORTS and BY-PRODUCTS

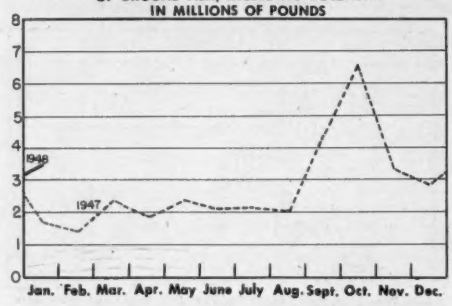
BOSTON - WEIGHTED AVERAGE PRICE
ON NEW ENGLAND FISH EXCHANGE IN ¢ PER POUND



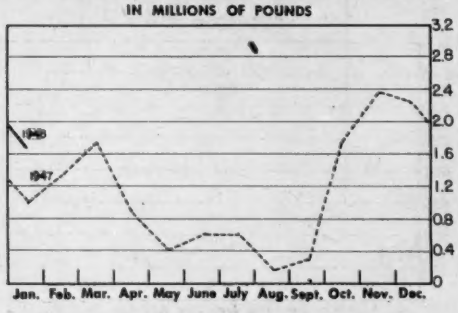
MAINE - IMPORTS OF SEA HERRING
IN THOUSANDS OF POUNDS



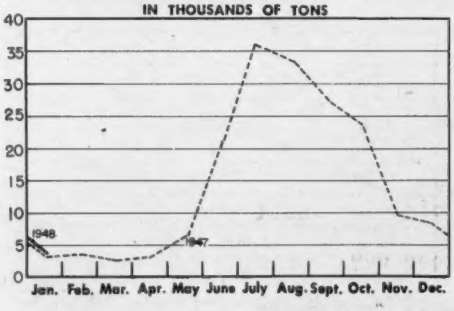
U.S. - IMPORTS OF FRESH & FROZEN FILLETS OF GROUND FISH, INCLUDING ROSEFISH:-
IN MILLIONS OF POUNDS



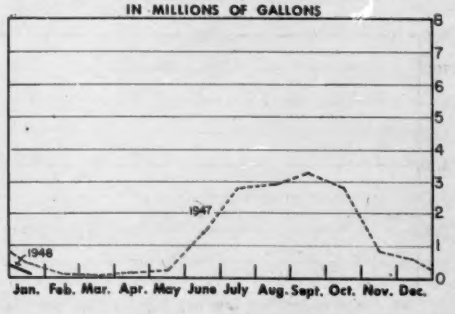
U.S. - IMPORTS OF SHRIMP FROM MEXICO
IN MILLIONS OF POUNDS



U.S. & ALASKA - PRODUCTION OF FISH MEAL
IN THOUSANDS OF TONS



U.S. & ALASKA - PRODUCTION OF FISH OIL
IN MILLIONS OF GALLONS



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILD LIFE SERVICE
WASHINGTON 25, D. C.

OFFICIAL BUSINESS
Permit No. 1015
Form MNWa - 4/48 - 2,750

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300

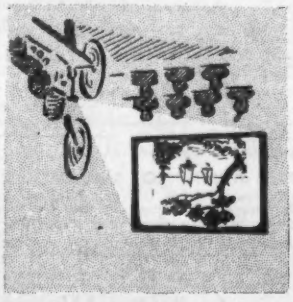
University of Michigan General Library,

Ann Arbor,

128D Michigan.

FISHERY MOTION PICTURES

Motion pictures on fishery subjects and a number of educational films dealing with subjects that are very closely related to commercial fishery operations are available from the Fish and Wildlife Service. Most of these films are 16 mm. sound motion pictures which may be borrowed free of charge upon request. The number of prints is limited, hence requests for booking the films should be made as far in advance as possible. Each request should indicate clearly the address to which the shipment is to be made. The shipments are usually made by express, the borrower paying transportation charges both ways. Although no charge is made for the use of the films, the user will be held responsible for any undue wear or tear of the film caused by faulty handling or dirty or faulty projectors. Sound films must not be run on silent projectors.



A list of the films available may be obtained free by requesting Fishery Leaflet 255 from the Division of Information, Fish and Wildlife Service, Washington 25, D.C. This also includes a partial listing of fishery films available from other sources.